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DIGITAL SUPPORT AS A FORMING FACTOR OF INNOVATIVE COMMUNITIES IN THE CONDITIONS OF SECURITY-ORIENTED SUSTAINABLE DEVELOPMENT OF ENTERPRISES IN UKRAINE

ЦИФРОВЕ ЗАБЕЗПЕЧЕННЯ ЯК ФАКТОР ФОРМУВАННЯ ІННОВАЦІЙНИХ СПІЛЬНОТ В УМОВАХ БЕЗПЕКООРІЄНТОВАНОГО СТАЛОГО РОЗВИТКУ ПІДПРИЄМСТВ В УКРАЇНІ

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In the current military conditions, the problem of combining human intelligence and the capabilities of information and computer technologies is more relevant than ever. Such interaction will allow to create self-managed innovative communities, which provide for the coordinated interaction of business, authorities and the population. The work established that the increase in the competitiveness of innovative communities under the influence of digitalization will not happen as quickly as we would like. This is due to the fact that for the efficient operation of the system under the influence of the fourth industrial revolution, time is needed for its adaptation to the new order. And furthermore, the benefits of digital services do not have a market value and are not captured in overall performance and performance assessments. The work considers a new criterion according to which the population is grouped depending on its attitude and the possibilities of using the latest research in the field of technology – the socio-technographic factor of segmentation. It has been determined what potential benefits business entities can receive from the implementation of Industry 4.0 technologies. It has been determined which 4.0 technologies are relevant today. It is indicated what steps should be taken by authorities and business entities for the development of innovative communities. They have been ranked. It has been established that the general increase in the level of technological capability will have an effective result only when the majority of the population has access to the latest technologies.

Key words: innovative communities, digitalization, Industry 4.0, latest technologies 4.0, socio-technographic segmentation, technological capability.

В теперішніх воєнних умовах як ніколи актуалізується проблема поєднання людського інтелекту та можливостей інформаційних комп'ютерних технологій. Така взаємодія дозволить створити самокеровані інноваційні спільноти, що передбачають узгоджену взаємодію бізнесу, влади та населення. Цифрова забезпеченість таких спільнот дозволить підвищити ефективність людської діяльності, сприятиме економічному розвитку та зростанню якості життя населення. Таким чином подальший повоєнний сталий розвиток територій не можли-

во представити без активного використання сучасних технологій Індустрії 4.0. Саме тому цифровізація та технологічна спроможність інноваційних спільнот є однією з передумов розвитку в довгостроковій перспективі. В роботі встановлено, що до цифрової спроможності частіш за все відносять: наявність новітніх технологій та рівень їх освоєння, прямі закордонні цифрові технології та технологічний трансферт, рівень індивідуального використання можливостей Інтернет тощо. Також виявлено, що підвищення конкурентоспроможності інноваційних спільнот під впливом цифровізації буде відбуватись не так швидко як хотілось би. Це пов'язано з тим, що для ефективного роботи системи під дією четвертої промислової революції необхідно час для її адаптації до нового порядку. Для цього необхідно впровадити достатню кількість інновацій щоб отримати нову якість. І крім того, переваги цифрових послуг не мають ринкової вартості і не фіксуються в загальному результаті діяльності та оцінках продуктивності. В роботі розглянуто новий критерій, згідно якого населення групують в залежності від його ставлення та можливостей використання останніх досліджень в сфері технологій – соціо-технографічний фактор сегментації. Розглянуто основні групи такої сегментації. Встановлено, які потенційні вигоди можуть отримати суб'єкти господарювання від впровадження технологій Індустрії 4.0. Встановлено, які саме найбільш популярні та сучасні технології 4.0 сьогодні є актуальними для суб'єктів господарювання. Виявлено, що більшість керівників вітчизняних промислових підприємств навіть не розуміють, що таке технології 4.0. Розглянуто головні критерії подальшого цифрового розвитку підприємств. Зазначено, які кроки повинні зробити органи влади та суб'єкти господарювання для розвитку інноваційних спільнот. Проведено їх ранжування. Встановлено, що загальне зростання рівня технологічної спроможності матиме ефективний результат лише тоді, коли більшість населення матиме доступ до новітніх технологій.

Ключові слова: інноваційні спільноти, цифровізація, Індустрія 4.0, новітні технології 4.0, соціотехнографічна сегментація, технологічна спроможність.

The problem. Today, the problem of combining human intelligence and the capabilities of information and computer technologies, which will allow the creation of self-managed innovative communities, which provide for the coordinated interaction of all layers of the population (business, government and the population), is becoming an actual issue. The technological capacity of such communities will allow to increase the efficiency of human activity, contribute to economic development and increase the quality of life of the population. Digitization of the processes of interaction between the government, business and the population of the region will allow to increase the efficiency and reduce the risk of innovative communities, increase the chances of market success, reduce losses from inefficient use of resources (by 2–3 times), significantly increase the level of competitiveness and strengthen the position on the national and foreign markets, to ensure the conditions for the transition to an innovative scientific and technological path of development.

Analysis of research and publications. This effect is based on the available experience presented in the works of such domestic and foreign scientists as: Kuybida V.S., Karpenko O.V., Namestnik V.V. [1]; Strutyńska I.V. [2], Tymoshenko, N., & Shabanova, M. [3]; Anthony S., Eyring M., Gibson L. [4]; Ariel Ezrachi, Maurice E. Stucke [5]; Bowonder B., Mani S. [6], Cassiman B., Valentini G. [7], Chesbrough, H., Bogers M. [8], Dougherty D. [9], Robert D. Hisrich, Michael P. Peters, Dean A. [10].

Isolation of previously unresolved parts of the general problem. However, these works mainly consider the experience of the development of technological and digital support of various business entities in the developed countries of the world. They do not take into account those conditions that are currently of primary importance for the domestic economy – the post-war restoration of the territories of Ukraine. Although the further post-war sustainable development of territories cannot be imagined without the active use of modern Industry 4.0 technologies.

The purpose and objectives of the article. Thus, the purpose of the article is to determine the nature of the impact of technological equipment and digital support on the development of innovative communities in the long term.

An overview of the main material. Technological capacity includes: the availability of the latest technologies, the level of technology adoption by enterprises, direct foreign technologies and technology transfer, the level of individual use of Internet opportunities, the level of use of broadband access, Internet bandwidth and mobile broadband subscriptions. All these factors are quite important for the overall ability to form innovative communities because they show the ability of professional researchers, innovators, authorities and the general population to connect with the general mass of individuals.

However, it takes some time. This is due to two main reasons:

1. First, in order for the system under the influence of the fourth industrial revolution to

work effectively, time is needed for its adaptation to the new order. After all, as a result of the impact of the digital revolution, a completely new system will be born, and not all subjects and people will benefit. So, for example, decades were needed in the past to ensure productivity growth from the electrification of production. For this, a number of additional innovations were introduced, such as the reorganization of production lines, etc.

2. Secondly, the advantages of digital services (including search engines, e-mail, digital maps, social networks, etc.) do not have a market value and are not recorded in the overall result of the activity and performance evaluations. Although all evidence suggests that they create overall value for end users.

Given the fact that the main factor in the spread of Industry 4.0 is digitization, let's consider the features of its application among the population.

Recently, in connection with the active development of the Internet, a criterion has become widespread, according to which the population is grouped depending on its attitude and the possibilities of using the latest research in the field of technology. This criterion was called the socio-technographic factor of segmentation. It is considered that the founder of such a criterion is the firm Forrester Research. According to the methodology proposed by her, consumers are divided into 7 groups:

- creators – develop social content for other consumers: publish blogs, their own web pages, upload developed videos, audio and music works, publish their own articles and stories, etc.;
- conversationalists – convey their opinion about certain events to other consumers using various means, for example, social networks (create and update them);
- critics – respond to messages received from others: publish reviews and ratings of services, leave comments on blogs, participate in forums, edit Wikipedia articles, etc.;
- collectors – organize content for themselves or other consumers using various means, such as RSS, tags, online voting sites, etc.;
- joiners – create their own pages in social networks, communicate using their capabilities;
- spectators – consume social content: read blogs, read newsletters, watch downloaded videos, read online forums, reviews and ratings, messages from others on Twitter, etc.;
- inactives – do not use modern technologies of the Internet communications market in any form.

In addition, somewhat different approaches to distinguishing different population groups

appear in modern literature, based on the socio-technographic criterion. Yes, people in the context of social and media communications are divided into:

- authorities – those who influence other consumers and receive recognition from them in a specific thematic field of communication and service provision;
- convectors – play the role of information mediators, connecting practically incompatible users (for example, members of two forums);
- helpers – provide the necessary support to the company's business processes through recommendations, advice and technical answers on thematic forums or blogs;
- brand advocates – users who of their own volition broadcast the value of the brand between personal offline and online communication, effectively influencing the behavior of existing customers.

In addition to digitalization of the population, it is also important to implement modern information technologies among enterprises. According to McKinsey data, the potential benefits that an enterprise can receive from the implementation of Industry 4.0 technologies are as follows:

1. In the field of equipment operation modes, by introducing "smart" energy consumption, informatization of products, optimization of equipment operation in real time, you can get a 3–5% increase in productivity.
2. In the field of loading production equipment – by introducing flexibility of routing, flexibility in the use of equipment, remote monitoring and control, predictive maintenance and augmented reality in maintenance, it is possible to reduce equipment downtime by 30–50%.
3. In the field of labor efficiency and safety – by implementing the interaction of people and robots, remote monitoring and control, digital efficiency management, automation of intellectual and physical labor, it is possible to increase the productivity of technical functions by 45–55% precisely due to labor automation.
4. In the field of logistics, by implementing lot size optimization, real-time supply chain optimization, and on-site 3D printing, you can reduce inventory storage costs by 20–50%.
5. In the field of product quality, by implementing digital quality management, advanced process control (APC), statistical process control (SPC), it is possible to reduce quality assurance costs by 10–20%.

6. In the field of demand forecasting – by implementing product development based on demand data and demand forecasting, it is possible to increase the accuracy of forecasts by up to 85%.

7. In the field of time to market – by introducing rapid modeling and experimentation, parallel design, open innovation and cooperation with the client, it is possible to reduce time to market by 20–50%.

8. In the field of after-sales service – by introducing self-service with the help of virtual technologies, remote product maintenance, predictive product maintenance, it is possible to reduce product maintenance costs by 10–40%.

According to McKinsey data, in recent years more than 80% of the heads of industrial enterprises believe that technologies 4.0 will completely change the situation on the market in the medium term. And already 30% of them are constantly engaged in the search for financing in this direction and actively invest in various innovative projects. As for Ukraine, more than 90% of managers of domestic industrial enterprises do not even understand what 4.0 technologies are. Many of them believe that the automation of machines and equipment is digitalization and 4.0 technologies. However, in reality, this includes the Internet of Things, smart devices, predictive models, augmented reality, etc. Technologies 4.0 also include:

1. Predictive analytics – when machines and equipment independently determine and predict the probability of downtime or shutdown. This will make it possible to save up to 40% on maintenance and reduce unplanned downtime by up to 50%.

2. Product life cycle management (PLM) – which involves the transfer of already known technologies to the cloud environment and the transformation of product information into valuable enterprise assets. However, unfortunately, in Ukraine, this direction is developed only by distributors of Western companies.

3. Augmented and virtual reality – when all the necessary information, drawings and prototypes appear not on paper, but in the form of virtual objects. To date, there are almost no domestic companies that would introduce this direction.

4. Vertical and horizontal integration of machines using OPC UA.

5. Production management systems are already the fourth generation of software

for managing production processes in real time. Such systems in Ukraine are typical for enterprises with a single order.

6. Smart devices and mobile applications – they can be used to monitor equipment, track wagons or machines, mobile personnel, etc. To a greater extent, such products in Ukraine are offered by Western manufacturers.

7. Cloud platforms and services are data processing centers, which are quite expensive for domestic industrial enterprises, which is why they switch to ready-made platforms. Although everything is equal, domestic enterprises do not understand the importance of cyber threats and do not want to pay for subscriber service.

8. Cyber security – in recent years, the number of really large-scale attacks in Ukraine has increased significantly, and this indicates that the introduction of a system of protection and countermeasures against attacks should be at every enterprise.

Today, the domestic field of IT technologies is really quite developed and shows good trends for further growth. Over the past 10 years, a whole system has been created in the country, which unites the spheres of formal and informal education, as well as numerous associations and enterprises. However, according to the latest data, only 5% of the turnover of the IT sector goes to the needs of domestic industrial enterprises. At the same time, more than 70% of the turnover is generally exported. The data indicate that the IT sector in Ukraine competes with other industries for qualified personnel and various types of support, and is not directed to the further technological development of industry and other sectors of the economy. Of course, this is not bad for the industry itself, but it is a rather bad fact for the country's economy as a whole. After all, according to the data of the World Economic Forum, Ukraine on the way to readiness for the fourth industrial revolution is in 92nd place in terms of the level of introduction of domestic ICT in industry among the 100 countries considered. The general place of Ukraine among all the considered countries in terms of the level of readiness for the 4th industrial revolution is 70. According to the indicator "the ability of the government to promote and stimulate the penetration of technologies in industry" – 99th place out of 100.

A significant problem in the way of technological capability of industrial enterprises is that most managers do not understand the importance of the human factor. The main

resource for innovation and further development today is knowledge, talent and the possibility of their application for various R&D. In addition, domestic enterprises need to introduce systems for managing these resources into their management processes.

According to the respondents of the survey "Sustainable digital development" [11], for the development of innovative ecosystems of industrial hi-tech segments, stakeholders of Industry 4.0, including government bodies and business associations, should (in order of importance):

1. Promote the best cases in the development of priority elements of innovation ecosystems (such as Centers 4.0, technology and science parks, incubators-accelerators, funds, etc.).

2. The government should develop economic incentives for enterprises that actively participate in the construction and development of innovative ecosystems and clusters.

3. Actively and collaboratively develop and promote industry digital transformation roadmaps.

4. Faster adjustment of export of products and services (since the domestic market will remain small for a long time).

5. Widely involve international donors in relevant development programs.

6. More actively demand from the government the implementation of national policies and development programs in the field of Industry 4.0.

7. It is faster to establish cluster development of industrial hi-tech.

8. Actively block "digital populism" and government PR on the achievements of the IT industry.

9. To demand more attention from the first persons of the enterprises to the issues of ecosystem and cluster development.

It should also be added that there is a direct relationship between how many households in a country have access to the Internet at home and how actively innovative activities are promoted in that country. In Ukraine, this share is about 55%, while in the Netherlands – 96%, Norway – 96.6%, Germany – 90.3%, Luxembourg – 96.8%, Denmark – 91.7%, Sweden – 91.0%, Finland – 89.9%. These countries themselves are among the most innovative countries in the world.

Conclusion. In general, it is worth noting that the general increase in the level of technological capability will have an effective result only when the majority of the population has access to the latest technologies. Only then will the result of breakthrough innovations take place – access to them should be maximal.

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